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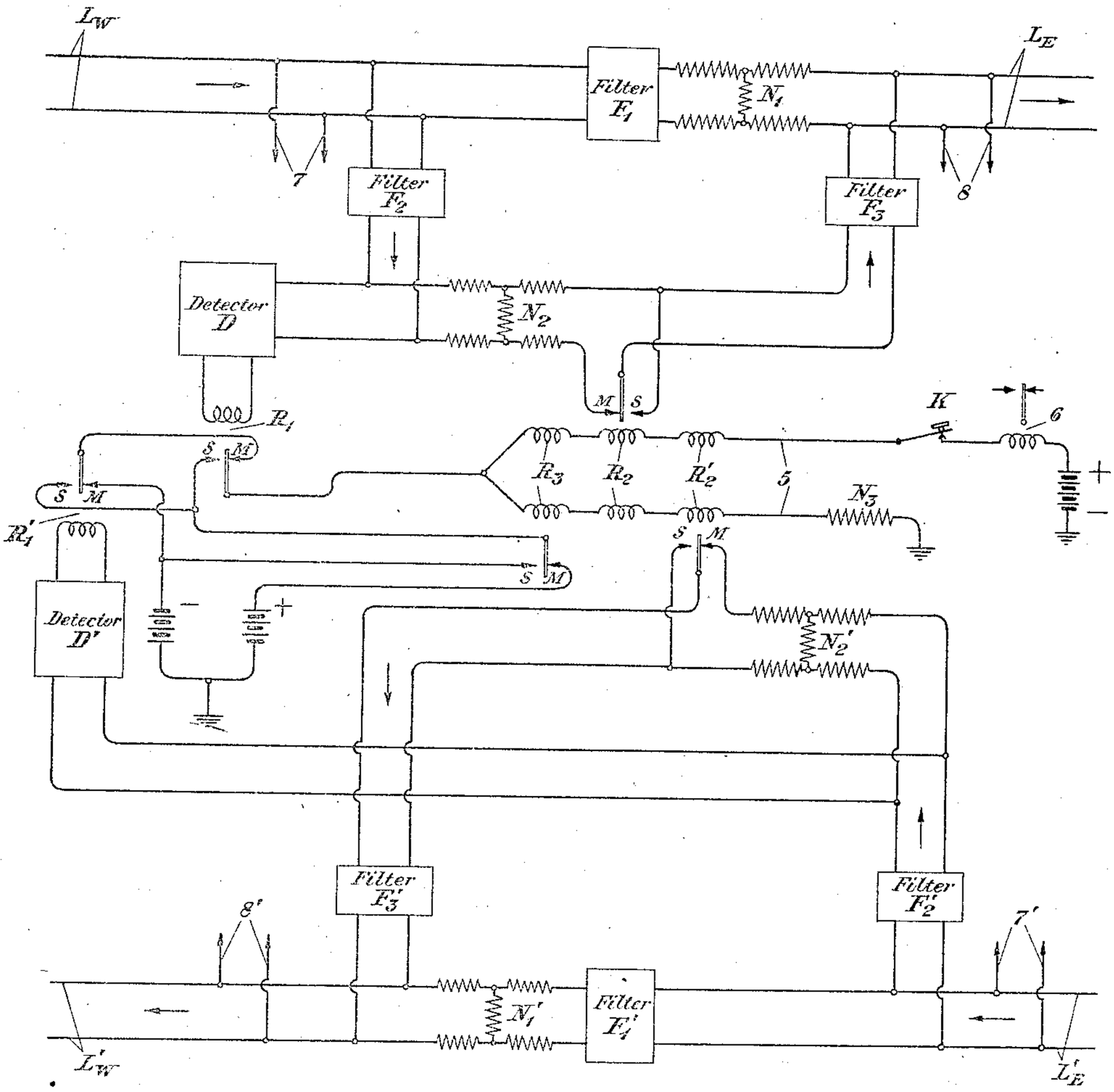

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INTERMEDIATE TELEGRAPH STATION.

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This invention relates to telegraph systems, and more particularly to improved arrangements for connecting telegraph subscribers to one or more channels of a carrier telegraph system at intermediate points between the terminal stations of such systems.

The intermediate set of this invention is particularly adapted for use with long carrier telegraph lines where a small number of connections is required at some place near the middle of the lines. With the arrangements of the invention a number of the desired carrier channels may be tapped at this intermediate point without providing terminal repeaters thereat and the necessity of back hauling the signals from the distant terminals to the intermediate point may be done away with. The intermediate set of the invention has the further advantage that it does not require a local carrier generator and that variations in the adjustments of telegraph apparatus at the intermediate set will have little or no effect upon through transmission. Other features and purposes of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description together with the accompanying drawing, in the figure of which is shown a circuit diagram of the intermediate set of the invention.

In the drawing are shown two lines interconnecting distant stations, one line composed of the line sections L*w* and L*e* and the other comprising the line sections L′*w* and L′*e*. These lines may represent either two sides of a four-wire voice frequency telegraph circuit, or the two transmission paths in opposite directions of a two-wire carrier telegraph repeater, or two transmission paths in opposite directions with two bands of frequencies located in different parts of the frequency spectrum in the case of high frequency carrier telegraph circuits. The description of the specific application of the invention which follows, however, will be confined to a four-wire voice frequency telegraph system, but it will be obvious that the arrangements may also apply to other types of systems such as those heretofore mentioned. The intermediate set is associated with these two lines and will tap any desired one of the telegraph channels transmitted thereover as will appear more fully from the following detailed description of its operation.

The carrier currents which arrive at the intermediate station over the lines L*w*L*e* and L′*w*L′*e* choose the following paths thereat: those currents arriving over line L*w*, which it is not desired to tap and for which no intermediate set is provided, pass through the filter F_1, network N_1, to line L*e*, and continue to the distant terminal station. Those currents for which an intermediate set is provided are prevented from passing through filter F_1 because this filter discriminates against them. These currents, therefore, choose one of the parallel paths around filter F_1, as, for example, the path which consists of the filter F_2 network N_2, armature and M contact of relay R_2, filter F_3, to line L*e*. Similarly, currents arriving from line L′*e* pass through identical circuit arrangements before reaching line L′*w*. In order to identify like elements in the two transmission paths, elements in the second path corresponding to those in the first path are designated with the same reference characters, but with the addition of the "prime."

The above description has served to show how the channels, into which it is desired to connect intermediate sets, may be separated from each other and from those channels on which such sets are not desired. The method of receiving and transmitting on these channels will now be described.

Let it be assumed for purposes of illustration that it is desired to tap one of the carrier telegraph circuits, for which the two transmission channels in opposite directions are located in the two transmission paths mentioned above. Let it be assumed further that the terminal sets for this particular telegraph circuit are arranged for half-duplex operation and that the transmitting keys on these terminal sets are closed. Under these conditions steady carrier currents will be received from the lines L*w* and L′*e* for the two channels of this telegraph circuit. The current for the channel on line L′*w*L′*e* will pass through the filter F'_2 and will divide between the detector D′ and the network N'_2. The current which flows into network N'_2 will pass on through filter F'_3 to the terminal sets connected to line L′*w*, while that portion of the current which

flows into the detector D′ will cause the armature of relay R'_1 to remain on its M contact. Similarly, the carrier current from the line L*w* of the channel under consideration passes through filter F_2 and divides between the detector D and network N_2. Accordingly, one portion of this current passes on to the distant station connected to line L*e*, while the other portion causes relay R_1 to rest on its M contacts. If the carrier current from line L*w* for the channel under consideration is being interrupted in accordance with telegraph signals, then relay R_1 will transmit telegraph signals into the differential loop circuit 5 and thereby operate the sounder 6 at the intermediate station. In a manner similar to the above, it will be apparent that if the signals were coming in over line L′*e* instead of line L*w*, then, relay R'_1 would be operating and transmitting signals into the differential loop 5 and relay R_1 would hold its armature on its M contact.

The differential loop circuit 5 utilized in the intermediate set of this invention for half duplex telegraph service is operated alternately by two separate receiving relays, R_1 and R'_1 in the manner described above. These relays are so arranged that either one may transmit a "break" signal into the loop, as will be pointed out hereinafter. The loop circuit 5 contains the windings of three differential polar relays, R_3, R_2 and R'_2. These relays are unaffected by signals originating at relays R_1 or R'_1, but are affected by signals originating at key K. The normal condition of operation of the carrier circuit, when arranged for half-duplex operation, is such that the armature of one of the two relays R_1 and R'_1 is resting on its M contact, while the other armature is transmitting signals into the loop. For this reason the armature of relay R'_1 may be connected to the M contact of relay R_1 in the manner shown on the drawing, with the result that either relay may transmit polar signals into the common apex of the loop circuit 5. Since spacing battery is connected to the S contacts of both relays, either relay may transmit a "break" signal in order to interrupt transmission from the other relay or from the loop.

When transmitting from the intermediate station all the other stations connected to the particular carrier channel under consideration will have their transmitting keys closed. This is the normal condition for half-duplex operation and will result in a steady carrier current being received at the intermediate station from the lines L*w* and L′*e*. If the key K at the intermediate station is then operated, relays R_3, R_2 and R'_2 will operate. This will result in the interruption of the steady carrier current by the armatures and contacts of relays R_2 and R'_2. These interrupted carrier currents pass through filters F_3 and F'_3 to the lines L*e* and L*w*, respectively, and will operate the receiving relays at the terminal stations in accordance with the signals originating at the intermediate station.

It is pointed out that detectors D and D′ at the intermediate station are not affected when the intermediate station is sending. This is due to the fact that the networks N_2 and N'_2 are connected into the circuit between the detectors and the points where the steady carrier currents are interrupted by the relays R_2 and R'_2, respectively. These networks are in the nature of artificial lines and present a fairly constant impedance to the input of the detectors, in spite of the fact that the circuit is being opened and closed at their other ends.

Considerable attenuation may be experienced by the currents of those channels to which an intermediate station is connected due to the losses in the networks and filters through which they pass. For this reason an equal loss is introduced by means of networks N_1 and N'_1 into those channels which pass through the filters F_1 and F'_1, respectively, and to which an intermediate station is not connected. In order to make up for this loss it will be necessary to increase the gain of the repeaters in the line, or, if this is not feasible, to connect an additional repeater into the line.

Whenever a terminal station wishes to interrupt the intermediate station, the transmitting key at the former station is opened. This interrupts the carrier current from that end of the line and effects one of the detectors and associated receiving relay at the intermediate station. As a result, spacing battery is connected to the apex of the intermediate loop circuit 5, thereby interrupting the intermediate station.

If the intermediate station wishes to interrupt a terminal station while the latter is sending, the key K at the intermediate station is opened. This gives the operator at the intermediate station control of the circuit by virtue of the local break relay R_3 and causes a "break" signal to be transmitted to the two terminal stations.

If it is desired to tap more than one carrier telegraph circuit at the intermediate station, other intermediate sets may be connected to the lines by conductors such as 7 and 8, 7′ and 8′.

For a full-duplex circuit, two differential loop circuits would be provided at the intermediate station. The break relay R_3 is then omitted and the relays R_1 and R_2 are associated with one of the two loop circuits and relays R'_1 and R'_2 with the other loop. The detailed circuit arrangements for such a connection are well known in the art and no further description thereof will be given.

While the invention has been disclosed as embodied in certain specific arrangements which are deemed desirable, it is understood that it is capable of embodiment in many other and widely varied forms without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A four-wire transmission system comprising two one-way line sections for transmission in opposite directions, selective circuits connected to each of said line sections, relay means in each of said selective circuits, and a local telegraph circuit jointly controlled by said relay means.

2. A carrier telegraph system comprising two one-way line sections for transmission in opposite directions, selective circuits connected in parallel with each of said line sections, relay means in each of said selective circuits responsive to the currents transmitted thereover, a local telegraph circuit controlled by said relay means, and means in said local telegraph circuit for interrupting said selective circuits.

3. A carrier telegraph system comprising two one-way line sections for transmission in opposite directions, selective circuits connected in parallel with each of said line sections, relay means in each of said selective circuits responsive to the currents transmitted thereover, and a differential local telegraph circuit having its apex connected to said relays whereby said local circuit may be under the joint control of said relays.

4. A carrier telegraph system comprising two one-way line sections for transmission in opposite directions, selective circuits connected in parallel with each of said line sections, detectors in each of said selective circuits, relay means associated with said detectors and controlled by the currents transmitted over said selective circuits, a local telegraph circuit controlled jointly by said relay means, and means in said local circuit for interrupting said selective circuits.

5. A four-wire transmission system comprising two one-way line sections for transmission in opposite directions, selective circuits connected in series in each of said line sections, additional selective circuits connected in parallel with said series selective circuits, relay means in each of said additional selective circuits, and a local telegraph circuit controlled by each of said relay means.

6. A four-wire transmission system comprising two one-way line sections for transmission in opposite directions, a combination of selective circuits connected into each of said line sections, relay means in certain ones of said combination of selective circuits, and local telegraph circuits controlled by said relay means.

7. A carrier telegraph system comprising two one-way line sections for transmission in opposite directions, selective circuits connected in series with each of said line sections, additional selective circuits connected in parallel with said series selective circuits, relay means in each of said additional selective circuits responsive to the currents transmitted thereover, a local telegraph circuit controlled by said relay means, and means in said local telegraph circuit for interrupting said selective circuits.

8. A carrier telegraph system comprising two one-way line sections for transmission in opposite directions, a combination of selective circuits connected into each of said line sections, relay means in certain ones of said combination of selective circuits responsive to the currents transmitted thereover, local telegraph circuits controlled by said relay means, and means in said local telegraph circuits for interrupting certain of said selective circuits.

9. A carrier telegraph system comprising two one-way line sections for transmission in opposite directions, selective circuits connected in series in each of said line sections, additional selective circuits connected in parallel with said series selective circuits, detectors in each of said additional selective circuits, relay means associated with said detectors and controlled by the currents transmitted over said last mentioned selective circuits, a local telegraph circuit controlled by said relay means, and means in said local telegraph circuit for interrupting said last mentioned selective circuits.

10. A carrier telegraph system comprising two one-way line sections for transmission in opposite directions, a combination of selective circuits connected into each of said line sections, detectors in certain ones of said combination of selective circuits, relay means associated with said detectors and controlled by the currents transmitted over said last mentioned selective circuits, local telegraph circuits controlled by said relay means, and means in said local telegraph circuits for interrupting said last mentioned selective circuits.

11. In a carrier telegraph system the combination with two one-way line sections for transmission in opposite directions between terminal stations of an intermediate carrier telegraph station comprising a plurality of selective circuits connected into each of said line sections, detectors in certain members of said plurality of selective circuits, relay means associated with said detectors and controlled by currents transmitted from said terminal stations over said selective circuit members, local telegraph circuits controlled by said relay means, and means in said local circuits for interrupting said currents transmitted from said terminal stations.

12. In a carrier telegraph system, the com-

bination with two one-way line sections for transmission in opposite directions between terminal stations, of an intermediate carrier telegraph station consisting of a plurality of selective circuits connected into each of said line sections, detectors in certain members of said plurality of selective circuits, relay means associated with said detectors and controlled by currents transmitted from said terminal stations over said selective circuit members, local telegraph circuits controlled by said relay means and arranged to receive signals transmitted over said line sections from said terminal stations, and means in said local circuits for sending signals to said terminal stations by interrupting the currents in said selective circuit members.

In testimony whereof, I have signed my name to this specification this 15th day of April, 1926.

JOSEPH HERMAN.